UPGRADING THE DX160

by Charles Molloy

The Realistic DX160 communications receiver was for several years available from Tandy in the UK and Radio Shack in the United States. There are still quite a few in use according to a recent survey reported in *DX Party Line* from HCJB (Voice of the Andes) and they can be picked up secondhand for quite a modest sum. This set has five bands. One from 150kHz to 400kHz includes long-wave broadcasting and navigation beacons while four others give continuous coverage from 535kHz to 30MHz. In addition to features one would expect, such as bandspread, antenna trimmer, r.f. gain control, noise limiter, S-meter, and product detector, there are also facilities one would normally find only in a more expensive set. There is amplified a.g.c., a front panel a.g.c. time constant switch with fast and slow action, a socket and plug for standby operation and the "front end" uses f.e.t.s.

The DX160 is a rather interesting, well-made set, attractive in appearance, easy to use and probably underrated performance wise. It operates either from the mains or 12 volts d.c., the latter feature attracting it to the writer who was looking for a receiver for use in a caravan and boat. Rather than leave it idle during the winter it was decided to try to hot it up so that it could be used as a second receiver for DXing. The only constraint was that it should be easy to restore it to its original state. This was imposed, not so much to maintain any resale value as to ensure that the set was still fit for mobile use the following season. Drilling holes or making changes to the printed circuit wiring, was out.

Digital Readout

Once you have used digital readout you cannot do without it. Tuning round the bands is so easy. As an Honest Frequency Meter model FC5M was in use with another receiver, a coaxial socket was fitted to the rear of the DX160 so that the FC5M could be plugged into this set as well.

In principle it should be easy to connect up an external digital readout. All you have to do is to tap onto the receiver's local oscillator. Provided the frequency meter has the correct offset, i.e. it will subtract the value of the i.f., the correct frequency will be displayed. The problem is how to do it without upsetting the local oscillator. A small amplifier acting as a buffer would certainly solve the problem but it is possible to manage without one. Tap a fixed capacitor onto the junction of C12, R32 and the drain of Q8, a convenient soldering point being at C12 (Fig. 1). C12 is located on the main p.c.b. which is on the left hand side of the set as viewed above from the front. It is signwritten on the top side of the board. The other end of the new capacitor goes to a coaxial socket fitted in place of the EXT STD BY socket at the rear. The wires from the latter are tied back and insulated from each other so that the external standby facility can be restored in future. The type of coaxial socket that stands proud will fit into the space available, even the holes for the self tappers line up.

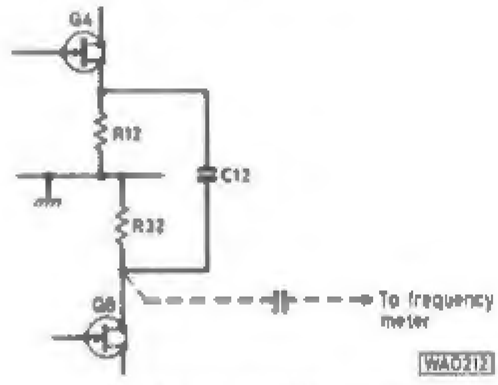
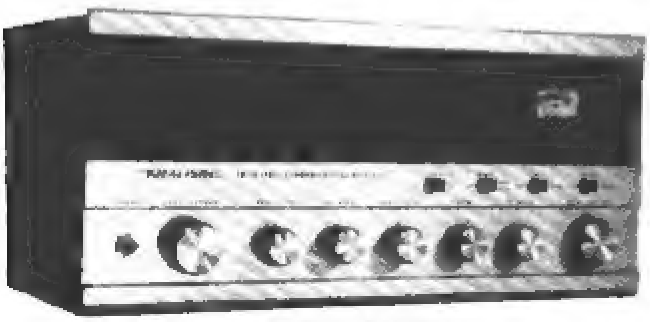


Fig. 1: DX160 digital readout

A 10pF fixed capacitor was used but the value may have to be found by trial and error if another frequency meter is used. It is a compromise between providing sufficient voltage at the lowest frequency and causing the least disturbance at the highest. A value of 33pF gave a good steady reading with the set tuned to 150kHz but detuned it by 7kHz and weakened the signal slightly on the 26MHz band, 4·7pF gave an unstable reading on the long waves.



The Realistic DX160

Band E

On this band (13MHz to 30MHz) the frequency displayed was 910kHz lower than it should have been. This value is double the i.f. (455kHz) and occurs because the local oscillator is adjusted to a frequency lower than the signal. On the other four bands the oscillator is higher than the incoming signal. This is not such a disaster as might at

first appear. Subtract 90kHz and the last three digits of the display will be correct. If you want to set up on a particular channel there is always the pocket calculator to fall back on.

An examination of the circuit showed that while padders (C37, C39, C40, C41) were in use for bands A to D, there was none for band E so the oscillator could just as easily be set above as below the signal frequency. It turned out to be a simple job to make the changeover. Since the tracking points were unknown it was assumed they would be 14MHz and 28MHz. Set the pointer to 28MHz and make a note of the actual reading on the digital display (not what it should be). Add 910kHz and call this f1. Now set the pointer to 14MHz, add 910 to the figure displayed and call this f2. Adjust the reading on the display to f2 using a non-magnetic trimming tool on the core of T15. Now set the pointer to 28MHz and adjust trimmer CT10 until f1 is displayed. Go back to 14MHz and readjust T15 and come back to 28MHz for a final touch on CT10. A 10pF capacitor bridged across CT10 will extend its range if necessary, the most convenient place to fit one being on the oscillator section of the wavechange switch, from the tag with the black wire to chassis.

If the mod is done this way there should be no need to re-align the r.f. circuits. If a signal generator is available then check the alignment and while you are at it check bands A to D as well.

Selectivity

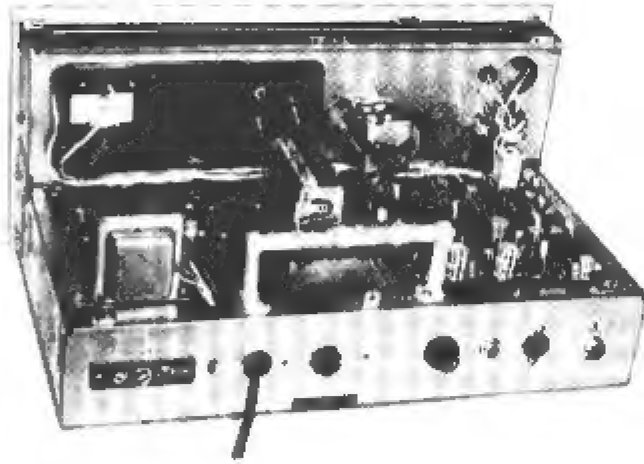
According to the users' handbook the bandwidth of the DX160 is 4kHz at the 6dB points and 18kHz at 40dB. Not bad for short wave programme listening but not so good for DXing. Selectivity is obtained from a ceramic filter and three adjustable single tuned i.f. transformers T16, T17 and T18. The ceramic filter is housed in the same can as T16. The DX160 is an inexpensive set which is likely to have been "aligned" on the assembly line. Some may never have been really spot-on, a conclusion reached as a result of the widely different accounts given of this set's performance.

It is not difficult to check if T16, T17 and T18 are peaked onto the ceramic filter. They are located in a row, parallel to the front panel on the top of the left hand printed circuit board as viewed from the front of the set. They are clearly signwritten, each slug being a different colour. T16 is red, T17 is white, T18 is black. You will need a trimming tool and preferably a signal generator though you can get away with tuning the set to a weakish signal giving a peak around 4 on the lower scale of the S-meter. The medium or long-waves in daylight should deliver a suitable signal. Mark the position of the slug's screwdriver slot in pencil on the can so that you can go back to it if necessary. Adjust the core slowly in either direction for a peak on the S-meter. Do one at a time and check if the receiver is functioning properly before moving to the next.

Sharpening the I.F. Responses

If you are adept enough to work on a p.c.b. with a small soldering iron then you can sharpen up selectivity. Simply replace the emitter bypass capacitors C16 and C19 with ceramic resonators. These capacitors are used to prevent negative feedback with consequent drop in receiver gain. Remove one and the output drops dramatically. Replace with a 455kHz resonator and the gain is restored but only close to 455kHz. The result is an improvement in selectivity.

Start with C16 which is the easier of the two. It is found between T16 and T17 close to Q5, all being signwritten on the component side of the board. The emitter, base and



collector of Q5 are labelled e, b, c on the lower side of the board, which helps in locating the solder points of C16. Using a small size soldering iron and a desoldering aid such as solder braid or a suction device, remove C16. The hole spacing on the board corresponds to the pin spacing of the resonator so the latter pushes in easily in place of C16. Solder below the board, check T16, T17 and T18 and try out the set.

If a further increase in selectivity is required, repeat the operation with C19 which lies between T17 and T18 and close to Q6. This time there is a problem as the hole spacing is wider but it is possible to spread out the flat pins of the resonator so that the tips partially enter the holes left by C19, from below the board, where they are soldered in place.

The ceramic resonators used are available from Ambit—ask for CFE455, 455kHz series type, stock number 16-45575. The dimensions are approx. 9 × 8 × 3mm with 5mm pin spacing and they are, if anything, slightly smaller than C16 and C19 which they replace.

Wide/Narrow Selectivity

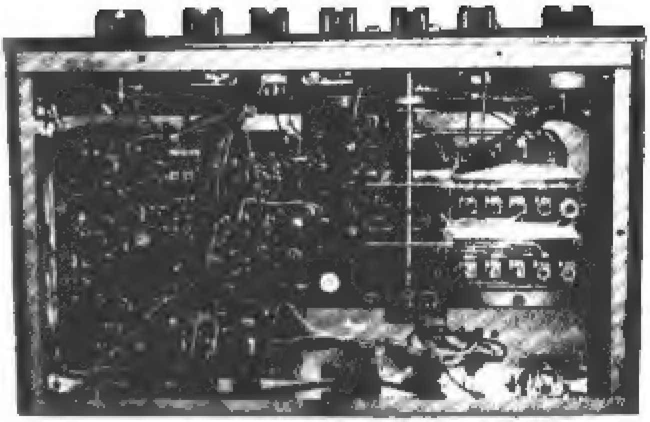
A receiver with fixed selectivity must be a compromise. If the selectivity is narrow, sideband cutting will occur. If it is wide, better quality audio will be paid for by an inability to winkle out DX. After C16 and C19 were replaced with resonators, sideband cutting was evident and detuning had to be resorted to for programme listening. The capacitor C19 value 40nF, which was now spare, was tapped across the resonator fitted in its place. This brought an immediate improvement to audio quality. One wire from this capacitor was now soldered onto the live side of the resonator (farthest from front panel) and a lead from the other wire led off to a switch and chassis. The front panel standby switch and its wiring, which comes to the main board, were used. The two wires from the switch, red and mauve, were cut at the board and leaving behind a couple of millimetres with insulation so that the solder points could be found again in the future. The red wire was soldered to chassis and the mauve wire to the "free" end of the 40nF capacitor (ex-C19).

In order to prevent the receiver being permanently on standby, go back to the two wires removed earlier from the standby socket and solder them together. If the standby socket was not removed, then insert a shorting plug in it. The standby switch now offers wide selectivity when in the REC position and narrow when moved to STD BY.

Using a Medium Wave Loop

Although there is a version of the DX160 that has a screened antenna tuning inductor (T2), the model in the possession of the writer has a ferrite rod antenna. It is mounted above the chassis close to the hardboard back and replaces T2 and also T3, the latter being the longwire coil. This ferrite rod performs a dual function being a tuning inductor as well as antenna. If it is removed then the receiver will not work on the medium waves or long waves.

Although there is a coupling winding on the ferrite rod which goes to the A1 and A2 terminals so that a loop antenna can be connected up, the loop is virtually useless. It cannot null out a signal picked up by the ferrite rod so its directional properties are masked. Since the cabinet is made of metal it is only through the hardboard back that signal pickup is possible. Replace the back with a metal one and the ferrite rod should be screened and the loop will be effective. As an experiment, the hardboard back was covered in kitchen foil. When refitted, the medium wave band, without antenna connected, was quiet except for a few strong local stations which now were barely audible. The loop performed very well and even when a few ventilation holes were cleared through the foil, near the sides, it continued to do so.



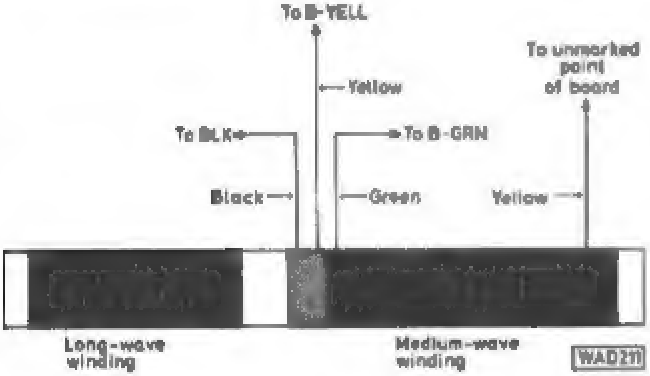


Fig. 2: Ferrite rod antenna, viewed from rear

Sensitivity on Medium Waves

Poor sensitivity on the medium waves is a complaint often made about the DX160 and one that is justified by the receiver specification. This quotes 50µV for band A, 100µV for band B (medium wave) and either 3µV or 4µV for bands C to E, all for a signal-to-noise ratio of 10dB, measured as (S+N)/N. It seems likely that the DX160 has been deliberately downgraded on the medium waves to ensure freedom from overloading on a band normally used for picking up local entertainment.

A modern screened r.f. transformer as a replacement for the ferrite rod antenna ought to provide a remedy and such a component, RW06A6408, stock number 35-64080, was obtained from Ambit. The base connections are shown in Fig. 3 and the ferrite rod antenna as viewed from the rear, is shown in Fig. 2.

There are four wires coming from points on the p.c.b. to the medium wave winding on the ferrite rod. These should be cut near the winding and taken to the new r.f. transformer instead. Start with the yellow wire on its own on the right (Fig. 2). It is cut near the winding and the free end soldered to pin 1 (Fig. 3). Move now to the three wires on the left hand side of the winding. The green one which comes from a point marked B-GRN is now terminated on pin 6, the black one from BLK goes to pin 3 and the remaining yellow wire coming from B-YELL is soldered to pin 4. The new r.f. transformer is soldered to a small bracket which is attached to the rear of the main tuning capacitor using the small screw that holds on a wiring clip. The four short ends of the wires left on the medium wave winding on the ferrite rod are tied onto the rod so that they are available in the future.

All that remains is to peak up at the l.f. end of the band using the slug on the new transformer, making sure that the antenna trimmer on the front panel is operative at the h.f. end. If not, then re-adjust the slug. There is no need to replace the hardboard back with a metal one as the ferrite rod antenna is now inoperative.

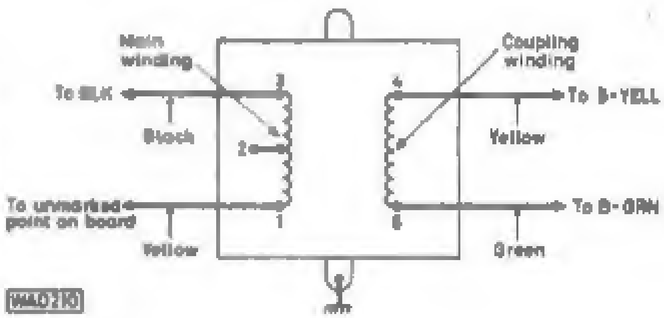


Fig. 3: Medium wave r.f. transformer connections

General Information

A copy of the DX160 circuit diagram, along with some notes, is available from the European DX Council, PO Box 4, St Ives, Huntingdon, PE17 4FE. Send 50p or three IRCs if abroad, and ask for the DX160 Receiver File. The circuit is of the version that does not have a ferrite rod antenna and the common end of the r.f. coupling windings instead of going to A2 are shown connected to chassis. This is probably an error in the drawing otherwise there would be no balanced antenna input.

The power socket at the rear of the DX160 allows 12V d.c. to be connected in place of the mains supply. There is no switching but there is a diode to protect against reverse polarity. The pilot lamps are run from their own winding on the mains transformer and do not light up when the set is run from batteries. As a result the power consumed is only 37mA with the volume at minimum which makes it

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feasible to run the set from dry batteries as an alternative to a car battery. The socket connections are shown in Fig. 4. If the plug is missing then a Tandy 274-1210 plug can be made to fit by removing one of its pins.

DX150

This receiver, with either the suffix A or B, pre-dates the DX160 but superficially it looks the same. The DX150 has only four bands, the long waves being omitted. It has an internal loudspeaker, the external loudspeaker sockets for the DX160 at the rear being replaced by a switch for changeover from mains to 12 volt working.

Internally there is quite a difference between the two receivers though the circuitry appears to be the same. The main p.c.b. of the DX150 is not silkscreened though T16, T17 and T18 are easily located but it is more difficult to identify C16 and C19 below the board. The components associated with the "front end" are on a separate small

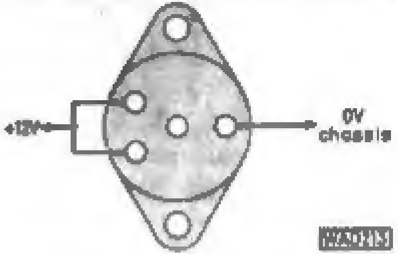

Fig. 4: Power socket connections

board mounted at right angles to the chassis beside the wavechange switch. Capacitor C16 can be found without difficulty as it is the large component adjacent to the oscillator section of the switch. Tapping on a fixed capacitor provided digital readout as before though this time 22pF was needed. The highest frequency band (D) has the oscillator on the I.f. side of the incoming signal. Un-screened coils are used in the r.f. and oscillator circuits but a space with hole is conveniently left for an r.f. coil for medium-wave use. ●